U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Solanum nelsonii*

COMMON NAME: Popolo

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: July 2005

STATUS/ACTION

___Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

__X_ Continuing candidate

___ Non-petitioned

_X__ Petitioned - Date petition received: May 11, 2004

_ 90-day positive - FR date:

_X_ 12-month warranted but precluded - FR date: May 11, 2005

_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? _yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? _yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 1980

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Solanaceae (Nightshade family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Midway, Laysan, Nihoa, Pearl and Hermes, Niihau, Kauai, Oahu, Molokai, Maui, Hawaii

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Nihoa, Pearl and Hermes, Niihau, Maui, Molokai, Hawaii

LAND OWNERSHIP: The largest population in the main Hawaiian Islands is on private land on Molokai, owned by The Nature Conservancy of Hawaii. The largest populations in the northwestern Hawaiian Islands are within the Hawaiian Islands National Wildlife Refuge, managed by the Service. The island of Niihau is privately owned. Land ownership on Maui is private and land ownership on the island of Hawaii is unknown.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Solanum nelsonii* is a sprawling or trailing shrub up to 1 meter (m) (3.3 feet (ft)) tall, forming clumps up to 1.5 m (4.9 ft) in diameter. Young stems and leaves are densely pubescent and do not have spines. Leaves are grayish green, have entire margins, are arranged alternately along the stems, and are broadly ovate. Flowers are perfect and have a white tubular corolla that is tinged with lavender to pale purple. Round berries are usually black when mature with numerous seeds. *Solanum nelsonii* is unusual in the genus with its sigmoid, purple anthers, which possibly suggest different pollinators than the usual solitary bees (Wagner *et al*. 1999a).

Taxonomy *Solanum nelsonii* was described by Dunal. This species is recognized as a distinct taxon in Wagner *et al*. (1999a), the most recently accepted Hawaiian plant taxonomy.

Habitat Typical habitat is coral rubble or sand in coastal sites up to 150 m (490 ft) in elevation

(Wagner *et al*. 1999a).

Historical and Current Range/Current Status *Solanum nelsonii* is known from ten populations totaling fewer than 300 individuals, and is declining rapidly on all islands, including the Hawaiian Islands National Wildlife Refuge. This species is found on the islands of Hawaii, Maui, Molokai, and Niihau. In addition, *S. nelsonii* is found on the island of Nihoa, and Pearl and Hermes Atoll, all within the Hawaiian Islands National Wildlife Refuge. In the past, this species was also found on the islands of Oahu, Kauai, Midway, and Laysan, but is probably no longer extant in these locations, due primarily to coastal development and the introduction of alien plant species (Joel Lau, The Nature Conservancy of Hawaii, pers. comm. 1995; Bill Garnett, private consultant, pers. comm. 1995; Rick Warshauer, U.S.G.S. Biological Resources Discipline, pers. comm. 1995; Robert Hobdy, Hawaii Division of Forestry and Wildlife, pers. comm. 2001; Ken Wood, National Tropical Botanical Garden, pers. comm. 2001).

THREATS:
A. The present or threatened destruction, modification, or curtailment of its habitat or range. Coastal habitat is prime area for resort and urban development, which threatens native coastal plant communities in the main Hawaiian Islands (J. Lau, Bill Garnett, Rick Warshauer, pers. comms. 1995). Coastal strand has been replaced on most islands by human habitation, starting with the first Hawaiians in 300-600 A.D. The few remaining remnant coastal strand communities, habitat for *Solanum nelsonii*, are often species poor, but were very likely more diverse prior to human impact. Recreational impacts, such as off-road vehicles and trampling by tourists, have made many of these remaining strand communities on the main Hawaiian islands unsuitable for *S. nelsonii* survival (Cuddihy and Stone 1990; Marie Bruegmann, U.S. Fish and Wildlife Service, pers. comm. 1997). Individuals of *S. nelsonii* found on Maui and the island of Hawaii are threatened by resort and urban development of their native coastal habitat, as well as habitat degradation and destruction from off-road vehicles and human trampling. No known conservation measures have been taken to date to address these threats to *S. nelsonii* on the islands of Maui and Hawaii. The individuals of *S. nelsonii* found on Nihoa, and Pearl and Hermes are not threatened by resort and urban development or by recreational impacts, such as off-road vehicles and trampling by tourists, because these activities are not allowed within the Hawaiian Islands National Wildlife Refuge. There is no public or recreational use allowed at the refuge. Access is strictly regulated through a permit system because of the sensitivity of the organisms on these islands to human disturbance (Hawaiian Islands National Wildlife Refuge 2005).

On Molokai, *Solanum nelsonii* is threatened by wild cattle (*Bos taurus*) and axis deer (*Axis axis*) that adversely modify habitat (W. Moses, *in litt*. 2005). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitats on Molokai. Cattle, the wild progenitor of which was native to Europe, northern Africa, and southwestern Asia, were introduced to the Hawaiian Islands in 1793. Large feral herds developed as a result of restrictions on killing cattle decreed by King Kamehameha I. While small cattle ranches were developed on Kauai, Oahu, and west Maui, very large ranches of tens of thousands of acres were

created on east Maui and Hawaii. Much of the land used in these private enterprises was leased from the State or was privately owned and classified as Forest Reserve and/or Conservation District land. Cattle eat native vegetation, trample roots and seedlings, cause erosion, create disturbed areas into which alien plants invade, and spread seeds of alien plants in their feces and on their bodies. The forest in areas grazed by cattle becomes degraded to grassland pasture, and plant cover is reduced for many years following removal of cattle from an area. Several alien grasses and legumes purposely introduced for cattle forage have become noxious weeds (Tomich 1986; Cuddihy and Stone 1990).

Axis deer, originally released on the island of Molokai in 1868, can now be found in extensive populations on the islands of Maui, Molokai and Lanai. Deer eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants.

Ungulate exclusion fences, and routine fence monitoring and maintenance, protect the population of *Solanum nelsonii* on Molokai (W. Moses, *in litt*. 2005). No other known conservation measures have been taken to date to address the threats from ungulates.

While sand mining was reported to threaten the population on Molokai ten years ago, this activity is not currently considered a major threat to this population (J. Lau, pers. comm. 1995; W. Moses, *in litt*. 2005).

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
None known.

D. The inadequacy of existing regulatory mechanisms.
None known.

E. Other natural or manmade factors affecting its continued existence.
Alien plant species are the major threat to this species (J. Lau, B. Garnett, R. Warshauer, pers. comms. 1995; W. Moses, *in litt*. 2005). The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Confirmed personal observations (J. Lau, B. Garnett, R. Warshauer, pers. comms. 1995; W. Moses, *in litt*. 2005) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998) indicate nonnative plant species may outcompete native plants similar to *Solanum nelsonii*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering

soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the coastal habitat of *S. nelsonii*, the Service believes nonnative plant species are a threat to this species. On Molokai, weed control is conducted in the area where *S. nelsonii* is found (W. Moses, *in litt*. 2005). Limited weed control is conducted in the Hawaiian Islands National Wildlife Refuge (Hawaiian Islands National Wildlife Refuge 2005). No other known conservation measures have been taken to date to address this threat.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Ungulate exclusion fences, and routine fence monitoring and maintenance, protect the population of *Solanum nelsonii* on Molokai. In addition, The Nature Conservancy of Hawaii is conducting weed control in the area where *S. nelsonii* is found (W. Moses, *in litt*. 2005). There is no public or recreational use allowed on the islands in the Hawaiian Islands National Wildlife Refuge. Access is strictly regulated through a permit system because of the sensitivity of the organisms on these islands to human disturbance. Limited weed control is conducted in the refuge (Hawaiian Islands National Wildlife Refuge 2005). This species is represented in *ex situ* collections (Hawaiian Islands National Wildlife Refuge facility on Laysan Island and Volcano Rare Plant Facility) and in seed storage (Lyon Arboretum Seed Storage Facility and Volcano Rare Plant Facility) (Cindy Rehkemper, U.S. Fish and Wildlife Service, *in litt*. 2005; Hawaiian Islands National Wildlife Refuge 2005; U.S. Fish and Wildlife Service Controlled Propagation Database 2005). No known conservation measures have been taken to date for *Solanum nelsonii* on Maui or the island of Hawaii.

SUMMARY OF THREATS:

The major threats to this species on Maui and the island of Hawaii include development, off-road vehicles, and trampling that degrade and/or destroy habitat, and nonnative native plants that complete for light and nutrients. No conservation measures have been taken to address these threats. On Molokai, the major threats to this species are wild cattle and axis deer that adversely modify habitat, and nonnative plants. Ungulate exclusion fences, and routine fence monitoring and maintenance, protect the population of *Solanum nelsonii* on Molokai from feral ungulates. In addition, The Nature Conservancy of Hawaii is controlling weeds in the coastal dune habitat of *S. nelsonii*. Limited weed control is conducted in the Hawaiian Islands National Wildlife Refuge. The threats to *S. nelsonii* on Niihau are unknown as this island is privately owned, access is restricted, and there is no available information.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	2*
		Subspecies/population	3
	Non-imminent	Monotypic genus	4

		Species Subspecies/population	5 6
Moderate to Low	Imminent	Monotypic genus Species Subspecies/population	7 8 9
	Non-imminent	Monotypic genus Species Subspecies/population	10 11 12

Rationale for listing priority number:

Magnitude:

On Maui and the island of Hawaii, this species is highly threatened by development, off-road vehicles, and trampling that degrade and/or destroy habitat and non-native plants that complete for light and nutrients. On Molokai, the major threats to *Solanum nelsonii* are wild cattle and axis deer that adversely modify habitat, and nonnative plants. On the Hawaiian Islands National Wildlife Refuge this species is threatened by nonnative plants. Threats to this species on Niihau are unknown. Threats to the coastal habitat of *Solanum nelsonii* and to individuals of this species occur throughout most of its range and are expected to continue or increase without their control or eradication. No known conservation measures have been taken to date for *S. nelsonii* on Maui, the island of Hawaii, or Niihau. On Molokai, conservation measures for this species include ungulate exclusion fences and weed control. On the island of Nihoa, and Pearl and Hermes Atoll there is no public or recreational use allowed as these islands are within the Hawaiian Islands National Wildlife Refuge. Limited weed control is conducted in the refuge. This species is represented in *ex situ* collections and in seed storage.

Imminence:

Threats to *Solanum nelsonii* from nonnative plants, development, off-road vehicles, and trampling are considered imminent because they are ongoing on Maui and the island of Hawaii.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted?

No. *Solanum nelsonii* does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. On Molokai, conservation measures for this species include ungulate exclusion fences and weed control. On the island of Nihoa, and Pearl and Hermes Atoll there is no public or recreational use allowed as these islands are within the Hawaiian Islands National Wildlife Refuge. Limited weed control is conducted in the refuge. This species is represented in *ex situ* collections and in seed storage. No known conservation measures have been taken to date for *S. nelsonii* on Maui, the island of Hawaii, or Niihau. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *S. nelsonii* as new information

becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:
Most of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communications with Joel Lau of The Nature Conservancy of Hawaii, Bill Garnett (private consultant), Rick Warshauer of U.S.G.S. Biological Resources Division, and Robert Hobdy of Hawaii's Division of Forestry and Wildlife. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004 the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information was provided in 2004. In 2005 we contacted the species experts listed below, and confirmation of the status of *Solanum nelsonii* on Molokai was provided by Wailana Moses and status information on the Hawaiian Islands National Wildlife Refuge was provided by a refuge staff member.

The Hawaii Natural Heritage Program identified this species as imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Vulnerable (likely to become endangered in the near future) by Wagner *et al*. 1999b.

One species expert has provided new information confirming the status of *S. nelsonii* on Molokai, this year, and the results are included in this assessment. In addition, a staff member of the Hawaiian Islands National Wildlife Refuge provided new information confirming the status of this species on refuge lands. Other species experts were contacted regarding *S. nelsonii* but did not provide new information this year, no new literature was found, and no known entities are studying this species. However, it is highly likely that the previously reported threats on Maui and the island of Hawaii continue to impact the species at the same or an increased level. The threats to, and current status of, *S. nelsonii* on Niihau are unknown as this island is privately owned, access is restricted, and there is no available information.

COORDINATION WITH STATES:
In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED
List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline

3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	June 28, 2005	National Tropical Botanical Garden
9. Ken Wood	June 28, 2005	National Tropical Botanical Garden
10. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife
11. Wailana Moses*	October 17, 2005	The Nature Conservancy of Hawaii

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004
2. U.S. Fish and Wildlife Service Controlled Propagation Database	2005

Other resources utilized:

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai`i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.

Hawaiian Islands National Wildlife Refuge. 2005. URL: http://www.fws.gov/refuges/profiles

Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.

Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.

Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Mus. Occas. Pap. 48: 23-36.

Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.

Meyer, J.-Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvescens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.

Robichaux, R., J. Canfield, F. R. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998.

Adaptive Radiation. Endangered Species Bulletin. November/December.
Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9:1-429. Cooper Ornithological Society, Los Angeles.
Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawai`i. Proceeding of the Second Conference on Natural Science, Hawaii Volcanoes National Park, pp. 274-288.
Smith, C.W. 1985. Impact of alien plants on Hawai`i's native biota: in Stone, C.P., and J.M. Scott (eds.), Hawaii's terrestrial ecosystems: preservation and management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 180-250.
Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejnanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21(1): 1-16.
Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the Flowering Plants of Hawai`i, Bishop Mus. Spec. Publ. 97:1-1918. University of Hawaii Press and Bishop Museum Press, Honolulu.
Wagner, W.L., M.M. Bruegmann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Mus. Occas. Pap. 60: 1-58.
Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawai‘i, version 3.1. December 12, 2003. Available from the Internet. URL: http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm.
Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____ 11/10/05
Regional Director, Fish and Wildlife Service Date

_____

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: September 16, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell_____ Date: September 19, 2005
Plant Conservation Program Leader

Gina Shultz_____ Date: October 14, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard_____ Date: October 14, 2005
Field Supervisor